

**Honeywell**

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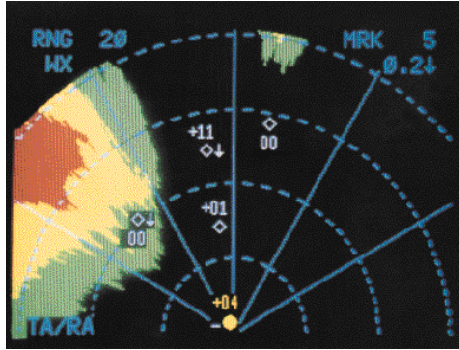
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**Honeywell**



# Collision Avoidance System User's Manual

The information contained in this manual is for reference use only. If any information contained herein conflicts with similar information contained in the Airplane Flight Manual, the information in the Airplane Flight Manual shall take precedence.

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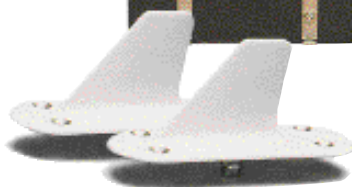
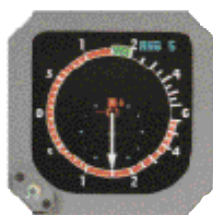
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## SECTION 1

### Introduction

#### SCOPE

This manual applies to systems which are compliant to RTCA DO185A MOPS Change 7.0 and RTCA “DO-185” MOPS Change 6.04a. These systems are referred to as TCAS II (Traffic Alert and Collision Avoidance System) in the United States and ACAS II (Airborne Collision Avoidance System) internationally. The terminology is used interchangeably and, for the purpose of discussion, TCAS II will be the terminology used in this manual.

#### WHAT IS THE TCAS II SYSTEM?

TCAS II is a system used for detecting and tracking aircraft in the vicinity of your own aircraft. By interrogating their transponders it analyzes the replies to determine range, bearing, and if reporting altitude, the relative altitude of the intruder. Should the TCAS II processor determine that a possible collision hazard exists, it issues visual and audio advisories to the crew for appropriate vertical avoidance maneuvers. **TCAS is unable to detect any intruding aircraft without an operating transponder.**

There are two types of cockpit displays for TCAS II, the Resolution Advisory (RA) display and the Traffic Advisory (TA) display. The RA display is incorporated into the vertical speed indicator (VSI). By illuminating red and green areas around the dial it displays the required rate, or limitation of climb or descent, to avoid a possible collision.

The TA display shows the intruding aircraft's relative position and altitude with a trend arrow to indicate if it is climbing or descending at greater than 500 feet per minute. This TA display may be provided on the weather radar indicator, on a dedicated TCAS display or a TA/VSI display.

The TA display identifies the relative threat of each intruder by using various symbols and colors.

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Complementing the displays, TCAS II provides appropriate synthesized voice announcements. A complete list of symbols and announcements is given in the Operation section of this User's Manual.

ATC procedures and the "see and avoid" concept will continue to be the **primary** means of ensuring aircraft separation. However, if communication is lost with ATC, TCAS II adds a significant backup for collision avoidance.

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## **SECTION 2**

### **Operation**

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### **The TCAS II System:**

- **Is compatible with and independent of the ATC System**
- **Determines if a threat exists**
- **Provides display and audio announcement to the crew**
  - Position information displayed on CRT and/or TA/VSI
  - Vertical guidance displayed on VSI
  - Synthesized voice
- **Calculates appropriate vertical evasive maneuver**
- **Coordinates maneuvers of two or more TCAS II equipped aircraft via Mode S transponder communication between aircraft.**

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## TCAS II OPERATION

The TCAS II system monitors the airspace surrounding your aircraft by interrogating the transponder of intruding aircraft. The interrogation reply enables TCAS II to compute the following information about the intruder:

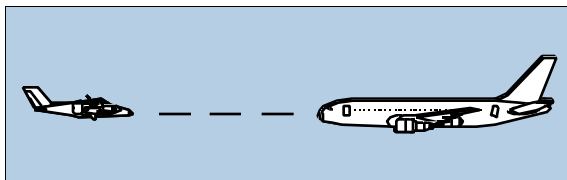
- 1) Range between your aircraft and the intruder.
- 2) Relative bearing to the intruder.
- 3) Altitude and vertical speed of the intruder, if reporting altitude.
- 4) Closing rate between the intruder and your aircraft.

Using this data TCAS II predicts the time to, and the separation at, the intruder's closest point of approach (CPA). Should TCAS II predict that certain safe boundaries may be violated, it will issue a Traffic Advisory (TA) to alert the crew that closing traffic is in the vicinity.

If the intruder continues to close, TCAS II will issue a Resolution Advisory (RA) to obtain or maintain safe vertical separation between your aircraft and the intruder. TCAS II bases the alarms on a five second crew reaction time to begin the separation maneuver. Increase or reversal of an RA requires a reaction in two and one half seconds.

---

TYPICAL  
TCAS II  
ENCOUNTER



Two TCAS II equipped aircraft will coordinate their resolution advisories using a Mode S transponder air-to-air data link. The coordination ensures that complementary advisories are issued in each aircraft. **The crew should promptly but smoothly follow the advisory. Since maneuvers are coordinated, the crew should never maneuver in the opposite direction of the advisory.**

TCAS II can track as many as 45 aircraft, display up to 30 of them and can coordinate a resolution advisory for up to three intruders at once. The advisories are always based on the least amount of deviation from the flight path while providing safe vertical separation.

---

**TCAS II  
TRAFFIC  
DISPLAY  
SYMBOLS**

TCAS II will display four different traffic symbols on the Traffic Advisory displays. The symbols change shape and color to represent increasing levels of urgency.

The traffic symbols may also have an associated altitude tag which shows relative altitude in hundreds of feet, indicating whether the intruder is climbing, flying level or descending. A + sign and number above the symbol means the intruder is above your altitude. A - sign and number beneath indicates it is below your altitude. A trend arrow appears when the intruder's vertical rate is 500 feet per minute or greater.

If the intruder is Non-Altitude Reporting (NAR) the traffic symbol appears without an altitude number or trend arrow. The type of symbol selected by TCAS II is based on the intruder location and closing rate.

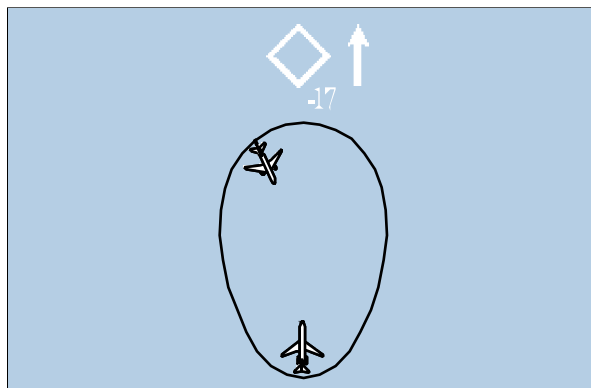
If TCAS direction finding techniques fail to locate the azimuth of another aircraft, a NO BEARING message appears on the screen.

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**NON-THREAT  
TRAFFIC**

An open white diamond indicates that an intruder's relative altitude is greater than plus or minus 1200 feet vertically or its distance is beyond 6 nm range. It is not yet considered a threat.

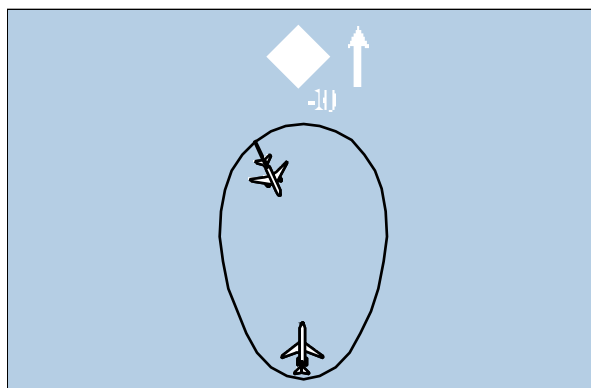
This one is 1700 feet below your own altitude, climbing at 500 feet per minute or greater.



**PROXIMITY  
INTRUDER  
TRAFFIC**

A filled white diamond indicates that the intruding aircraft is within plus or minus 1200 feet vertically and within 6 nm range, but is still not considered a threat.

This intruder is now 1000 feet below your aircraft and climbing.



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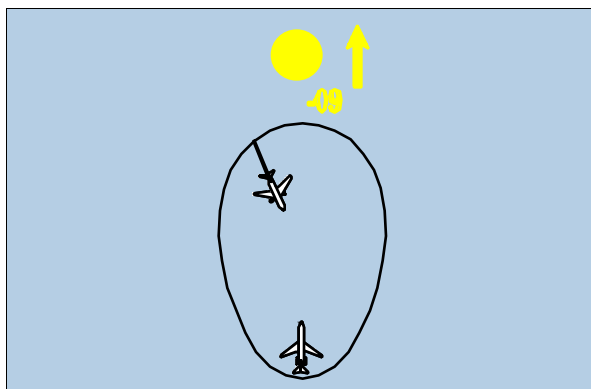
**TRAFFIC  
ADVISORY (TA)**

A symbol change to a filled yellow circle indicates that the intruding aircraft is considered to be potentially hazardous. Depending on your altitude TCAS II will display a TA when the time to CPA is between 20 and 48 seconds.

Here the intruder is 900 feet below your aircraft, climbing at 500 feet per minute or greater. A voice announcement is heard in the cockpit, advising,

## **“Traffic, Traffic”**

Under normal conditions a TA will precede an RA by 10 to 15 seconds. **The crew should attempt to gain visual contact with the intruder and be prepared to maneuver should an RA be sounded 10 to 15 seconds later. The crew should take no evasive actions based solely on the TCAS II display.**



**RESOLUTION  
ADVISORY  
(RA)**

A solid red square indicates that the intruding aircraft is projected to be a collision threat. TCAS II calculates that the intruder has reached the point where a Resolution Advisory is necessary. The time to closest approach with the intruder is now between 15 and 35 seconds depending on your altitude. The symbol appears together with an appropriate audio warning and a vertical maneuver indication on the RA/VSI. Voice announcements are listed later in this section. This aircraft is now 600 feet below your altitude and still climbing. A synthesized voice announces a vertical maneuver command, such as,

**“Climb, Climb, Climb.”**

(Change 6.04a)

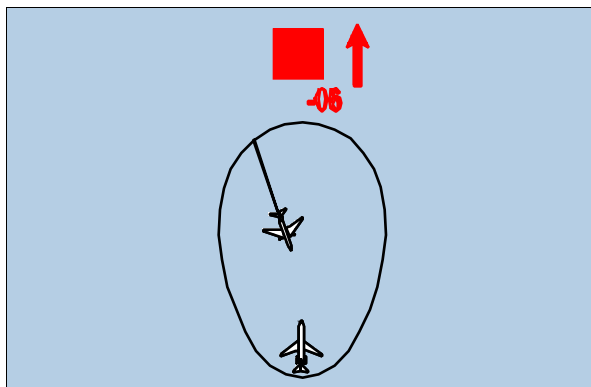
**or**

**“Climb, Climb.”**

(Change 7.0)

The pilot should smoothly but firmly initiate any required vertical maneuver within 5 seconds from the time the RA is posted, using pitch cues or the Vertical Speed Indicator as appropriate.

An intruder must be reporting altitude in order to gen-



erate an RA. Therefore, the RA symbol will always have an altitude tag.

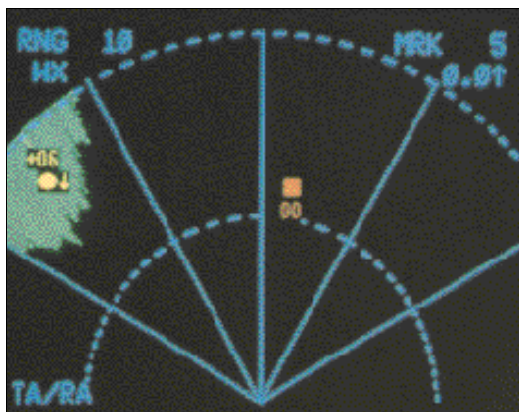
## OFF SCALE TRAFFIC

The presence of TA or RA aircraft that are beyond the selected display range is indicated by one half of the traffic symbol at the edge of the screen. The position of the half-symbol represents the bearing of the intruder.

TA AND RA TRAFFIC  
OFF SCALE, TCAS  
MODE FORMAT.



SAME TRAFFIC ON  
10 MILE RANGE,  
WEATHER MODE  
FORMAT.





---

## THE RA/VSI INSTRUMENT

TCAS II guidance is incorporated into the vertical speed indicator. Two rows of colored lights, one green and one red, are located around the vertical speed scale. TCAS II uses the lights to indicate whether to climb, descend or remain level. The lights are OFF unless an active Resolution Advisory is in progress.

Resolution Advisories are grouped as **Corrective Advisories** or Preventive Advisories. Corrective Advisories require a positive action by the crew accompanied by a green arc on the RA/VSI showing “Fly To” guidance. **Preventive Advisories** require that NO action be taken to alter the flight path of the aircraft.

When TCAS issues an RA, certain segments in the row of red lights will be turned on. Segments in the row of green lights will be on when the pilot is required to actively maneuver the aircraft to satisfy the resolution advisory. For safe separation from the intruder, the pilot should maneuver the aircraft within the vertical speeds represented by the green lights. Vertical speeds within the red area must be avoided.

An RA may be presented on the VSI requiring avoidance of two or more threat aircraft simultaneously. For example a “do not descend” indication may be visible at the same time a “limit climb rate” indication appears because of threat aircraft above and below your own aircraft.

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THE TA/VSI  
INSTRUMENT

The TA/VSI combines the plan position of intruding aircraft and TCAS II guidance on the vertical speed instrument.

A pointer and circular vertical speed scale indicate aircraft vertical rate. Resolution Advisories are shown as red and green bands outside of the scale. The center of the display presents intruding traffic. Refer to Section 3 for a detailed description of the TA/VSI.

HOW TO  
FLY TYPICAL  
TCAS II  
COMMANDS –  
CHANGE  
6.04A

The Resolution Advisory is incorporated into the Vertical Speed Indicator. By illuminating red and green light bands around the dial, “Fly-To” and “Fly-Away-From” commands are displayed coinciding with the required vertical rate. **Maneuver the aircraft promptly and smoothly in response to the Resolution Advisory.**

Some of the typical Resolution Advisories shown on the RA/VSI will require a maneuver by the crew while others will warn against maneuvering. A typical TCAS II maneuver requires crew response within 5 seconds and G-forces of  $\pm .25$  G. This force is similar to that experienced when initiating an enroute climb or descent. **Because of this G-force requirement, the response to the RA cannot be flown using the autopilot. The autopilot must be disconnected prior to responding to the RA.**

The following diagrams illustrate typical TCAS II encounters showing intruder traffic on a display and the corresponding resolution on the RA/VSI.

INDICATIONS  
AND VOICE  
ANNOUNCE-  
MENTS

CHANGE 6.04A

## **“Climb, Climb, Climb.”**



COMMENTS

**Situation:**

The intruder is ahead at 12:00 o'clock, 200 feet below your altitude.



**Crew Response:**

Promptly and smoothly establish a climb rate of 1500 feet per minute.

INDICATIONS  
AND VOICE  
ANNOUNCE-  
MENTS

CHANGE 6.04A

## “Monitor Vertical Speed, Monitor Vertical Speed.”



COMMENTS

**Situation:**

One intruder is ahead at 12:00 o'clock, 500 feet above your altitude. Another is 500 feet below your altitude.



**Crew Response:**

Remain in level flight. Do not climb or descend.

INDICATIONS  
AND VOICE  
ANNOUNCE-  
MENTS

CHANGE 6.04A

## “Monitor Vertical Speed.”



COMMENTS

**Situation:**

The intruder is ahead at 12:00 o'clock, 500 feet below your altitude and flying level.



**Crew Response:**

Do not descend.

INDICATIONS  
AND VOICE  
ANNOUNCE-  
MENTS

CHANGE 6.04A

## “Traffic, Traffic”



COMMENTS

**Situation:**

The intruder is ahead at 12:00 o'clock, beyond 5 miles, 200 feet below your altitude.



**Crew Response:**

You do not maneuver on the Traffic Advisory symbol. Attempt to visually acquire the intruder and be prepared to maneuver if the TA changes to an RA.

INDICATIONS  
AND VOICE  
ANNOUNCE-  
MENTS

CHANGE 6.04A

## “Monitor Vertical Speed.”



COMMENTS

**Situation:**

The intruder is ahead at 12:00 o'clock, 400 feet above your altitude. You are already climbing at 2000 feet per minute.



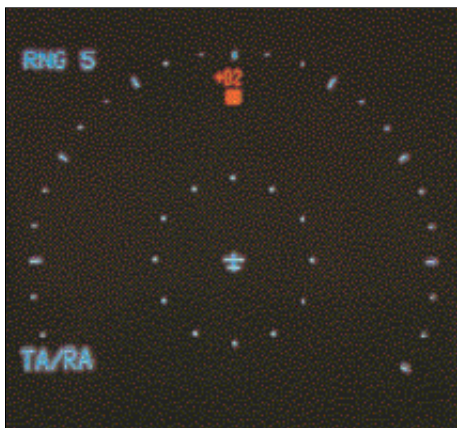
**Crew Response:**

Maintain climb at present rate.

INDICATIONS  
AND VOICE  
ANNOUNCE-  
MENTS

CHANGE 6.04A

## **“Descend, Descend, Descend.”**



COMMENTS

**Situation:**

One intruder is ahead at 12:00 o'clock, 200 feet above your altitude.



**Crew Response:**

Promptly and smoothly establish a descent rate of 1500 feet per minute.



INDICATIONS  
AND VOICE  
ANNOUNCE-  
MENTS

CHANGE 6.04A

## **“Climb; Climb Now, Climb, Climb Now.”**



COMMENTS

**Situation:**

The intruder is ahead and above and has changed from level flight to a rapid descent after TCAS issued a descend RA. TCAS is now changing that to a climb.



**Crew Response:**

You are expected to initiate the change from a descent to a climb maneuver within 2.5 seconds with an increase in G-force to .35 Gs.

INDICATIONS  
AND VOICE  
ANNOUNCE-  
MENTS

CHANGE 6.04A

## “Clear of Conflict”



COMMENTS

**Situation:**

The intruder has passed behind and is now 600 feet below your altitude. It is no longer a threat.



**Crew Response:**

Return promptly to the previous ATC clearance.

---

HOW TO  
FLY TYPICAL  
TCAS II  
COMMANDS –

CHANGE 7.0

The Resolution Advisory is incorporated into the Vertical Speed Indicator. By illuminating green and red light bands around the dial, “Fly-To” and “Fly-Away-From” commands are displayed coinciding with the vertical rate required to comply with the Resolution Advisory. **Maneuver the aircraft promptly and smoothly in response to the Resolution Advisory.**

Some of the typical Resolution Advisories shown on the RA/VSI will require a maneuver by the crew while others will warn against maneuvering. A typical TCAS II maneuver requires crew response to the initial RA within 5 seconds and G-forces of  $\pm .25$  G. This force is similar to that experienced when initiating an enroute climb or descent. **Because of this G-force requirement, the response to the RA cannot be flown using the autopilot. The autopilot must be disconnected prior to responding to the RA.** When the initial RA is changed, the crew must respond within 2 1/2 seconds.

The following diagrams illustrate typical TCAS II encounters showing intruder traffic on a display and the corresponding resolution on the RA/VSI.

INDICATIONS  
AND VOICE  
ANNOUNCE-  
MENTS

CHANGE 7.0

## **“Climb, Climb.”**



COMMENTS

**Situation:**

The intruder is ahead at 12:00 o'clock, 200 feet below your altitude and flying level.



**Crew Response:**

Promptly and smoothly establish a climb rate of 1500 feet per minute.

INDICATIONS  
AND VOICE  
ANNOUNCE-  
MENTS

CHANGE 7.0

## “Adjust Vertical Speed, Adjust.”



COMMENTS

**Situation:**

The previous intruder is now 500 feet below your altitude while still at 12:00 o'clock and flying level after your having followed the CLIMB RA.



**Crew Response:**

Promptly and smoothly level the aircraft.

INDICATIONS  
AND VOICE  
ANNOUNCE-  
MENTS

CHANGE 7.0

## “Maintain Vertical Speed, Maintain.”



COMMENTS

**Situation:**

One intruder is ahead at 12:00 o'clock, 500 feet above your altitude. Another is at 500 feet below your altitude. Both are flying level.



**Crew Response:**

Remain in level flight. Do not climb or descend.

INDICATIONS  
AND VOICE  
ANNOUNCE-  
MENTS

CHANGE 7.0

## “Monitor Vertical Speed, Monitor Vertical Speed”



COMMENTS

**Situation:**

The intruder is ahead at 12:00 o'clock, 500 feet below your altitude and flying level.



**Crew Response:**

Do not descend. Maintain level flight.



INDICATIONS  
AND VOICE  
ANNOUNCE-  
MENTS

CHANGE 7.0

## “Traffic, Traffic”



COMMENTS

**Situation:**

The intruder is ahead at 12:00 o'clock, beyond 5 miles, 200 feet below your altitude.



**Crew Response:**

You do not maneuver on the Traffic Advisory symbol. Attempt to visually acquire the intruder and be prepared to maneuver if the TA changes to an RA.



INDICATIONS  
AND VOICE  
ANNOUNCE-  
MENTS

CHANGE 7.0

## “Maintain Vertical Speed, Crossing Maintain”



COMMENTS

**Situation:**

The intruder is ahead at 12:00 o'clock, 400 feet above your altitude and flying level. You are already climbing at 2000 feet per minute.



**Crew Response:**

Maintain climb at present rate.

INDICATIONS  
AND VOICE  
ANNOUNCE-  
MENTS

CHANGE 7.0

## **“Descend, Descend.”**



COMMENTS

**Situation:**

One intruder is ahead at 12:00 o'clock, 200 feet above your altitude and flying level.



**Crew Response:**

Promptly and smoothly establish a descent rate of 1500 feet per minute.

INDICATIONS  
AND VOICE  
ANNOUNCE-  
MENTS

CHANGE 7.0

## **“Climb, Climb Now, Climb, Climb Now.”**



COMMENTS

**Situation:**

The intruder is ahead and above and has changed from level flight to a rapid descent after TCAS issued a descend RA. TCAS is now changing that to a climb.



**Crew Response:**

You are expected to initiate the change from a descent to a climb maneuver within 2.5 seconds using an acceleration of .35 Gs.

INDICATIONS  
AND VOICE  
ANNOUNCE-  
MENTS

CHANGE 7.0

## “Clear of Conflict”



COMMENTS

**Situation:**

The intruder has passed behind and is now 600 feet below your altitude. It is no longer a threat.



**Crew Response:**

Return promptly to the previous ATC clearance.

---

**RECOVERY  
AFTER CLEAR  
OF CONFLICT**

- If initially in level flight, promptly but smoothly return to the previously assigned altitude unless otherwise directed by ATC.
- If climbing or descending resume the planned climb or descent after the intruder has passed by unless otherwise directed by ATC.

**AUDIO  
ANNOUNCE-  
MENTS –  
CHANGE 6.04A**

Synthesized voice announcements are issued by TCAS II over the aircraft audio system. The following tables list all of the Resolution Advisories, audio messages and advisories in the TCAS II vocabulary.

**AUDIO  
MESSAGES  
  
CHANGE 6.04A**

CONDITION	ADVISORY MESSAGE
TRAFFIC ADVISORY	“Traffic, Traffic”*
RA CLEARED	“Clear of Conflict”
SELF TEST PASSED	“TCAS System Test OK”
SELF TEST FAILED	“TCAS System Test Fail”*

\*“Traffic” is spoken once if a second TA appears.

**RESOLUTION  
ADVISORIES  
AND  
SYNTHESIZED  
VOICE  
ANNOUNCE-  
MENTS**

**CHANGE 6.04A**

<b>RA CATEGORY</b>	<b>CORRECTIVE</b>	<b>PREVENTIVE</b>
CLIMB	“Climb, Climb, Climb”	“Monitor Vertical Speed, Monitor Vertical Speed”
DESCENT	“Descend, Descend, Descend”	“Monitor Vertical Speed.* Monitor Vertical Speed”
CROSSOVER CLIMB	“Climb, Crossing Climb, Climb, Crossing Climb”	“Monitor Vertical Speed. Monitor Vertical Speed”
CROSSOVER DECENT	“Descend, Crossing Descend. Descend, Crossing Descend”	“Monitor Vertical Speed. Monitor Vertical Speed”
VERTICAL SPEED RESTRICTED (CLIMBING)	“Reduce Climb, Reduce Climb”	“Monitor Vertical Speed. Monitor Vertical Speed”
VERTICAL SPED RESTRICTED (DESCENDING)	“Reduce Descent Reduce Descent”	“Monitor Vertical Speed. Monitor Vertical Speed”

\*“Monitor Vertical Speed” is spoken once if downgraded from a previous corrective advisory.

The following Resolution Advisories are changes from those previously issued and require two and one half seconds response time and up to .35 G.

**LIST OF  
RESOLUTION  
ADVISORIES**

**CHANGE 6.04A**

CHANGE FROM CLIMB TO DESCENT	“Descend, Descend NOW. Descend, Descend NOW”	(N/A)
CHANGE FROM DESCENT TO CLIMB	“Climb, Climb NOW. Climb, Climb NOW”	(N/A)
INCREASE CLIMB RATE	“Increase Climb, Increase Climb”	(N/A)
INCREASE CLIMB RATE	“Increase Descent, Increase Descent”	(N/A)

---

**AUDIO  
ANNOUNCE-  
MENTS –  
CHANGE 7.0**

Synthesized voice announcements are issued by TCAS II over the aircraft audio system. The following tables list all of the Resolution Advisories, audio messages and advisories in the TCAS II vocabulary.

**AUDIO  
MESSAGES**

**CHANGE 7.0**

CONDITION	ADVISORY MESSAGE
TRAFFIC ADVISORY	“Traffic, Traffic”*
RA CLEARED	“Clear of Conflict”
SELF TEST PASSED	“TCAS System Test OK”
SELF TEST FAILED	“TCAS System Test Fail”*

“Traffic” is spoken once if a second TA appears.

**RESOLUTION  
ADVISORIES  
AND  
SYNTHESIZED  
VOICE  
ANNOUNCE-  
MENTS**

**CHANGE 7.0**

<b>RESOLUTION ADVISORY</b>	<b>AUDIO MESSAGE</b>
CLIMB	“Climb, Climb”
DESCENT	“Descend, Descend”
CROSSOVER CLIMB	“Climb, Crossing Climb- Climb, Crossing Climb”
CROSSOVER DESCENT	“Descend, Crossing Descend- Descend, Crossing Descend”
VERTICAL SPEED RESTRICTED (CLIMBING OR DESCENDING)	“Adjust Vertical Speed, Adjust”
ANY WEAKENING OR SOFTENING OF AN RA	“Adjust Vertical Speed”
PREVENTATIVE ADVISORY	“Monitor Vertical Speed”
MAINTAIN EXISTING VERTICAL SPEED	“Maintain Vertical Speed, Maintain”
MAINTAIN EXISTING VERTICAL SPEED WHILE CROSSING THREAT’S ALTITUDE	“Maintain Vertical Speed, Crossing Maintain”

The following Resolution Advisories are changes from those previously issued and require two and one half seconds response time and up to .35 G.

**LIST OF  
RESOLUTION  
ADVISORIES**

**CHANGE 7.0**

CHANGE FROM CLIMB TO DESCENT	“Descend, Descend NOW - Descend, Descend NOW”
CHANGE FROM DESCENT TO CLIMB	“Climb, Climb NOW - Climb, Climb NOW”
INCREASE CLIMB RATE	“Increase Climb - Increase Climb”
INCREASE DESCENT RATE	“Increase Descent - Increase Descent”





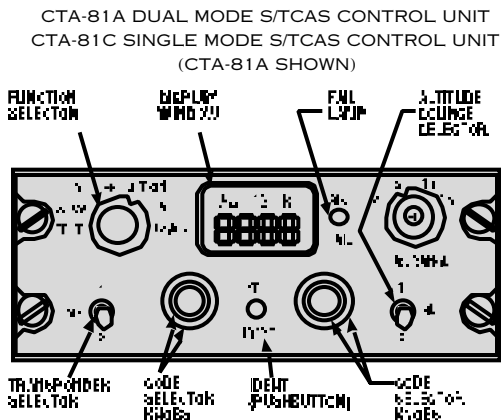
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## SECTION 3

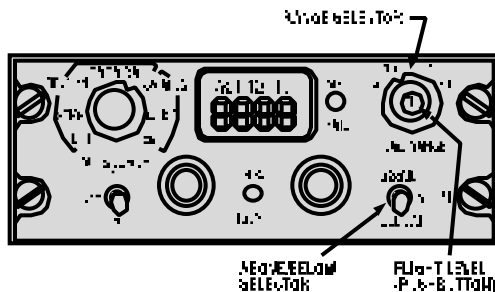
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**TRANSPONDER/  
TCAS  
CONTROL  
UNIT;  
CTA-81A,  
CTA-81B,  
CTA-81C**



CTA-81B MODE S/ATCRBS/TCAS  
CONTROL UNIT



**CTA-81A,  
CTA-81B,  
CTA-81C  
CONTROLS  
AND DISPLAYS**

The CTA-81 ( ) Control Unit is the master control for both the TCAS system and transponder. The CTA-81A controls two Mode S transponders. The CTA-81B controls one Mode S transponder and one ATCRBS transponder. The CTA-81C controls one Mode S transponder.

**NOTE:** Controls vary depending on CTA-81 ( ) configuration installed. Control functions same as typical unit shown.



The **Display Window** Displays ATC code selection and whether transponder No. 1 or No.2 is active. The R blinks indicating interrogation reply of ATCRBS transponder only.



**ATC 1-2** selects the active transponder. The other unit is placed in standby.



**ALT ON/OFF** turns altitude source ON or OFF.



Concentric knobs select **ATC** code in code window.



The **ATC FAIL Lamp** indicates failure of the selected transponder.

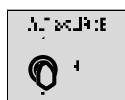


(Pushbutton)

**ATC IDENT** initiates IDENT feature for ATC.



**ALT 1-2 (CTA-81A) or ALT SOURCE 1/OFF/2 (CTA-81B)** selects one of two altitude sources Air Data Computer No. 1 or No.2. OFF position disables altitude squawk.





The **TCAS RANGE** Selector selects the Traffic Advisory display range in nautical miles.

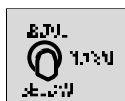


(Pushbutton)

The **FL** pushbutton (Center of TCAS Range Knob) replaces intruder's relative altitude with absolute altitude in flight level format for 15 seconds. During this period your own altitude, expressed as flight level, is displayed. After 15 seconds flight level reverts back to relative altitude.

The FL function is inhibited below 18,000 feet MSL unless barometric corrected altitude is available from an air data computer. In this case the FL function is available at any altitude.

If FL is selected while inhibited, "FL—" will replace own flight level.



**A/B** (Above/Below) toggle switch selects altitude display limits. Three levels to choose from.

**ABOVE** (Climb phase)

9000 feet above; 2700 feet below -  
Change 7.0

8700 feet above; 2700 feet below -  
Change 6.04a

**NORMAL** (Enroute phase)

2700 feet above; 2700 feet below.

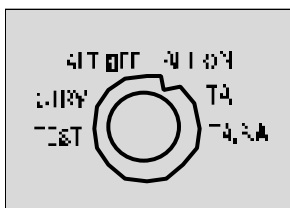
**BELOW** (Descent phase)

2700 feet above; 9000 feet below -  
Change 7.0

2700 feet above; 8700 feet below -  
Change 6.04a

**FUNCTION  
SELECTOR  
CTA-81A/C  
CONTROL  
UNIT ONLY  
(SELECTS  
OPERATING  
MODE)**

Moving the spring loaded knob to **TEST** position for one second initiates a comprehensive self test lasting approximately twelve seconds. Refer to the Test section in the Appendix for a detailed description of test functions.



**STBY** places Mode S transponder and TCAS system in standby.

**ALT OFF** activates transponder without altitude reporting. TCAS system in standby.

**ALT ON** activates transponder with altitude reporting. TCAS system in standby.

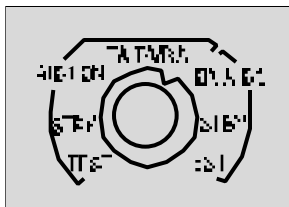
**TA** Traffic Advisory mode. Presents traffic location on TA display but does not issue Resolution Advisories. TA mode annunciation appears on displays. Activates transponder and altitude reporting.

**TA/RA** Traffic Advisory and Resolution Advisory mode. Presents traffic location on displays and issues audio and visual Resolution Advisories for traffic determined to be a threat. TA/RA mode annunciation appears on PPI or ITA-81A displays. Activates transponder and altitude reporting.

**FUNCTION  
SELECTOR  
CTA-81B  
CONTROL  
UNIT ONLY  
(SELECTS  
OPERATING  
MODE)**

**There are no TCAS functions on the ATC 2 (3 most clockwise) positions.**

The left **ATC 1 TEST** position (CCW) tests the Mode S transponder and the TCAS system. The right **ATC 2 TEST** position (CW) tests the ATCRBS transponder.



Moving the spring loaded knob to either **TEST** position initiates a self test in the respective unit. Refer to the Test section in the Appendix for a detailed description of test functions.

Selection of either **STBY** position places both transponders and TCAS II system in standby.

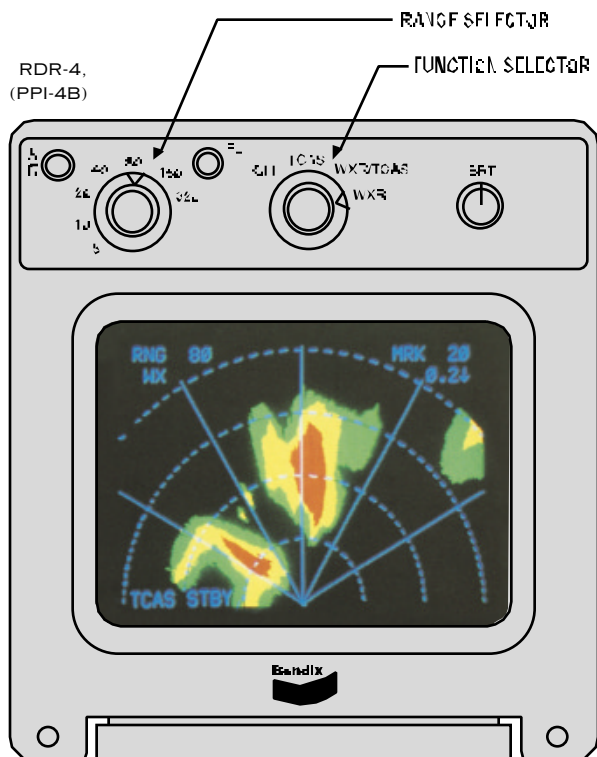
**ATC 1 ON** activates the Mode S transponder. TCAS in standby.

**ATC 2 ON** activates the ATCRBS transponder. TCAS in standby.

**TA** Traffic Advisory mode. Presents traffic location on displays but does not issue Resolution Advisories. TA mode annunciation appears on displays. Mode S transponder activated with altitude reporting

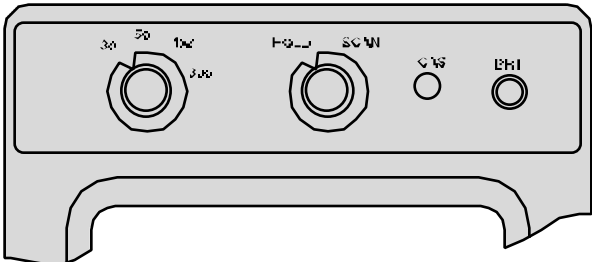
**TA/RA** Traffic Advisory and Resolution Advisory mode. Presents traffic location on displays and issues audio and visual Resolution Advisories for traffic determined to be a threat. TA/RA mode annunciation appears on PPI or ITA-81A displays. Mode S transponder activated with altitude reporting.

WEATHER  
RADAR  
INDICATORS;  
RDR-4,  
RDR-1F,  
RDR-1E

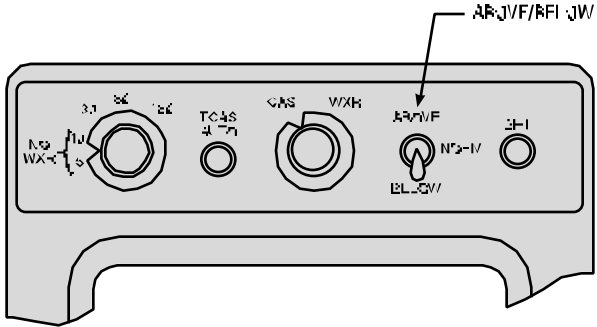




RDR-1F,  
(PPI-1T)



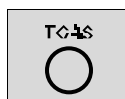
RDR-1E,  
(PPI-1U)



---

**PPI-1T,  
PPI-1U  
AND PPI-4B  
INDICATOR  
CONTROLS**

**NOTE:** Control arrangement varies depending on PPI radar configuration installed. TCAS control functions are the same as typical unit shown.



(Pushbutton)

TCAS cycles through display modes; WX/TCAS Pop-Up, WX/TCAS Overlay, and TCAS Only.

At Power-Up the screen initially displays the TCAS Only mode. Pressing the TCAS button once changes the display to WX Only mode.

Pressing again changes the display to WX/TCAS Overlay. (TCAS traffic is overlaid on weather.)

Pressing again changes the display back to the TCAS Only mode.

In WX/TCAS Pop-Up mode, the display shows the selected radar function.

When a TA or RA occurs, the display automatically switches to the TCAS Only mode. The range changes to the previously selected TCAS range.

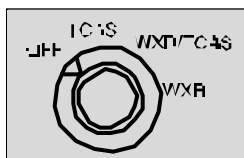
Pressing the TCAS button once after a Pop-Up event occurs returns the display to previous weather. The display will once again be interrupted if another TA or RA Pop-Up penetrates the protected range of your aircraft. When the traffic is no longer a threat, the screen automatically reverts to displaying weather.



(Pushbutton)

**MSG.** The message pushbutton activates the ACARS mode. During ACARS display a TCAS Pop-Up event replaces the ACARS page with TCAS Only. When the traffic is no longer a threat the screen automatically reverts back to displaying ACARS.

Pressing the MSG button once during the event reverts the display back to the previous ACARS display page. The display will once again be interrupted if another TA or RA event occurs.



This **Function Selector** turns on the weather radar system and selects the operating mode; TCAS selects a TCAS only display, WXR/TCAS selects weather with TCAS overlay display, and WXR selects a weather only display.

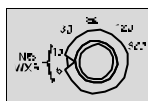


(Pushbutton)

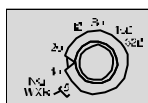
Pressing the FL pushbutton replaces intruders relative altitude with flight level. During this period your own flight level is displayed. Pressing the button again changes the display back to relative altitude.

The FL function is inhibited below 18,000' MSL unless barometric altimeter settings are available from the air data computer.

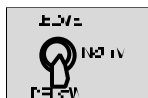
PPI-1T,  
PPI-1U  
AND PPI-4B  
INDICATOR  
CONTROLS  
(CONT'D)



The **Range Selector** selects range to be displayed. In the position labeled **NO WXR**, the display shows TCAS traffic only (no radar).



**WARNING:** The RDR-1E/ED and RDR-1F transmitters continue to radiate in the 5 and 10 mile NO WXR ranges if an active mode is selected on the radar control panel (any mode except TEST). Refer to the appropriate Weather Radar Operating Manual for Cautions and Limitations prescribed by FAA Advisory Circular 20-68B.



The **A/B** (Above/Below) pushbutton or toggle switch selects altitude display limits. Three levels to choose from:

**ABOVE** (Climb phase)

9000 feet above; 2700 feet below -  
Change 7.0

8700 feet above; 2700 feet below -  
Change 6.04a

**NORMAL** (Enroute phase)

2700 feet above; 2700 feet below.

**BELOW** (Descent phase)

2700 feet above; 9000 feet below -  
Change 7.0

2700 feet above; 8700 feet below -  
Change 6.04a





The **Function Selector** turns on the weather radar system and selects operating mode; either a TCAS mode or a Weather mode.



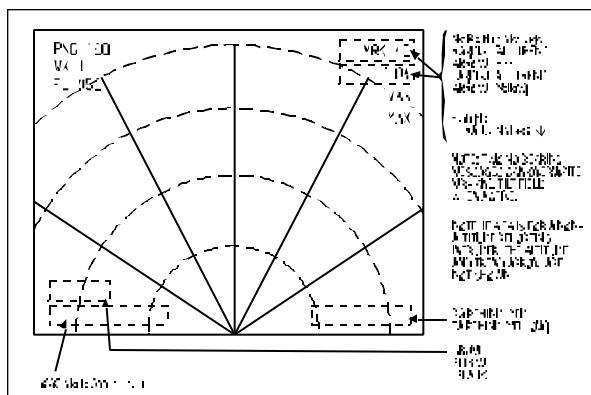
WEATHER Modes	TCAS Mode
<p>The Weather modes; WX, TURB and MAP, show the display origin at the bottom center of the screen. The weather and TCAS views are forward. The display shows radar functions with TCAS overlay depending on the selection by the TCAS AUTO pushbutton.</p> <p>At Power-Up the screen initially displays the WX/TCAS overlay mode. Mode annunciation is the TCAS operational mode.</p>	<p>In the TCAS position TCAS ONLY function is selected. No Weather is displayed. The airplane symbol appears in the lower 1/3 of the screen displaying traffic ahead of and behind your aircraft.</p> <p>At Power-Up the screen initially displays all TCAS traffic only. Mode annunciation is the TCAS operational mode.</p>



(Pushbutton)

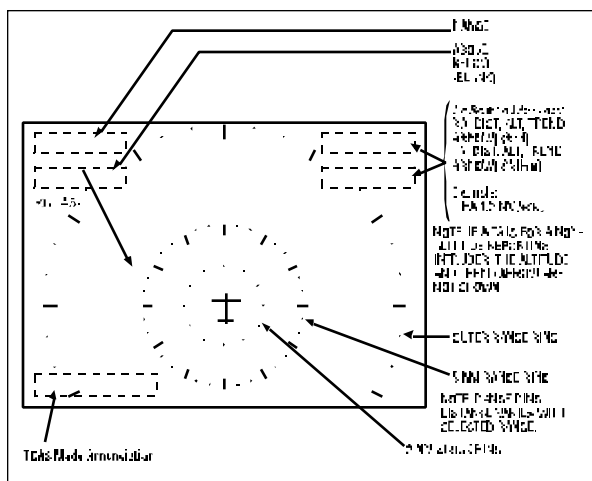
WEATHER Modes	TCAS Mode
<p>Pressing the button changes the mode to TCAS Pop-Up which displays WX only until a TA or RA intruder appears. Annunciation changes to TA AUTO or TA/RA AUTO. When TA/RA traffic enters the protected area all TCAS traffic is shown over weather. When the intruder is no longer a threat the screen automatically reverts back to displaying weather only. Pressing the button once more changes the display back to WX/TCAS overlay mode.</p>	<p>Pressing the button once changes to TCAS Pop-Up mode. TCAS AUTO is annunciated. In Pop-Up mode the screen clears and remains blank until TA or RA traffic appears. Then all TCAS traffic is displayed. The screen automatically clears when the intruder is no longer a threat. Pressing the button once more changes the display back to Full-Time display of all traffic.</p>

**WEATHER  
MODES  
MESSAGE  
FORMAT**



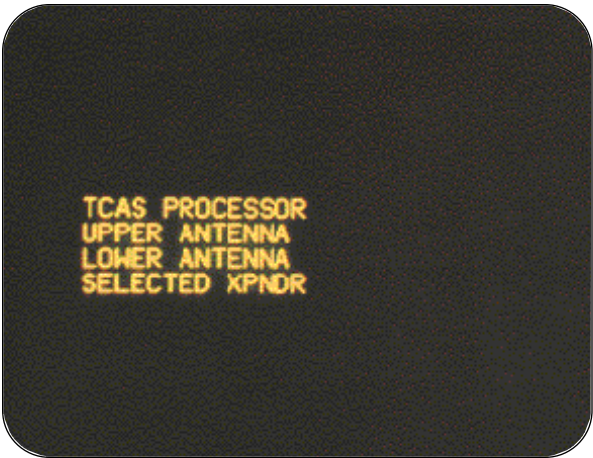
TCAS STBY	(Blue)	—	TCAS system in standby
TEST	(Blue)	—	TCAS system in TEST
TA/RA	(Blue)	—	TA/RA Mode
TA/RA AUTO	(Blue)	—	TA/RA Pop-Up Mode
TA ONLY	(Blue)	—	TA Only Mode
TA AUTO	(Blue)	—	TA Only Pop-Up Mode
TD FAIL	(Yellow)	—	Indicator Failure
NO TCAS	(Blue)	—	TCAS not operational. Place Function Selector to TCAS for a list of faults.
TCAS FAIL	(Yellow)	—	Failures include: TCAS Processor or Top or Bottom TCAS Ant- enna. Place Function Selector to TCAS for a list of faults.

# TCAS MODE MESSAGE FORMAT



TCAS STBY	(Blue)	—	TCAS system in standby
TEST	(Blue)	—	TCAS system in TEST
TA/RA	(Blue)	—	TA/RA Mode
TA/RA AUTO	(Blue)	—	TA/RA Pop-Up Mode
TA ONLY	(Blue)	—	TA Only Mode
TA AUTO	(Blue)	—	TA Only Pop-Up Mode
TD FAIL	(Yellow)	—	Indicator Failure

**FAULT  
MESSAGE  
FORMAT**



**FAULT  
ANNUNCIATIONS**

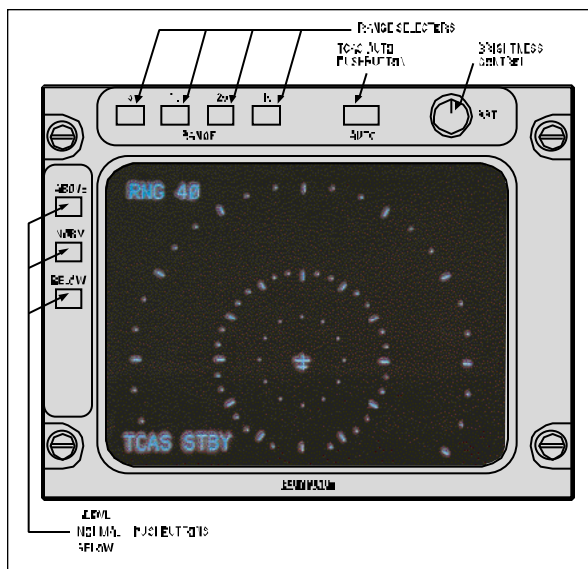
TCAS PROCESSOR	RA DISPLAY #1 and #2
UPPER ANTENNA	SELECTED XPNDR
LOWER ANTENNA	XPNDR TOP ANT
RADIO ALT #1	XPNDR LOWER ANT
RADIO ALT #2	XPNDR TCAS DATA
RADIO ALT #1 and #2	XPNDR CONTROL DATA
#1 XPNDR DATA BUS	XPNDR ALT DATA #1 and #2
#2 XPNDR DATA BUS	#1 XPNDR ALT DATA
TRAFFIC DISPLAY	#2 XPNDR ALT DATA
RA DISPLAY #1	ATTITUDE
RA DISPLAY #2	HEADING

**NOTE:** If a fault occurs while in the WX function (TCAS FAIL annunciated), switch to the TCAS function for a list of faults.

If already in the TCAS function, faults come up automatically.



ITA-81A  
DEDICATED  
TCAS TRAFFIC  
DISPLAY



ITA-81A  
DEDICATED  
TCAS TRAFFIC  
DISPLAY  
CONTROLS

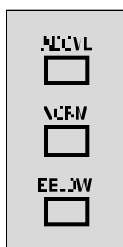


Pushbutton **Range Selectors** select range to be displayed.



**TCAS/AUTO Pushbutton:**At Power-Up the screen initially displays all TCAS traffic. Pressing the button alternates between Full-Time and TCAS Pop-Up modes.

When in Pop-Up mode the screen clears and remains blank until TA or RA traffic appears. Then all TCAS traffic is displayed. TCAS AUTO is annunciated. The screen automatically clears when the intruder is no longer a threat. Pressing the TCAS/AUTO button when no TCAS traffic is displayed returns the display to the Full-Time mode.



Pushbutton controls select vertical display limits.

**ABOVE (Climb phase)**

9000 feet above; 2700 feet below - Change 7.0  
8700 feet above; 2700 feet below - Change 6.04a

**NORMAL (Enroute phase)**

2700 feet above; 2700 feet below.

**BELOW (Descent phase)**

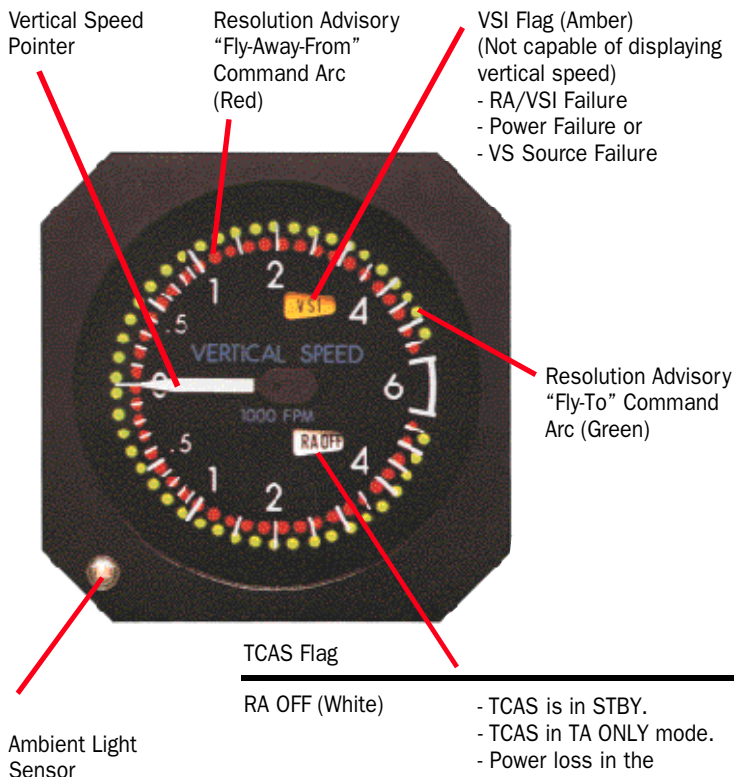
2700 feet above; 9000 feet below - Change 7.0  
2700 feet above; 8700 feet below - Change 6.04a



Adjusts display brightness.

**IVA-81B  
RA/VSI  
RESOLUTION  
ADVISORY/  
VERTICAL  
SPEED  
INDICATOR**

Two rows of colored lights, one red and one green, are located around the vertical speed scale. The RA/VSI indicates whether to climb, descend, remain level or otherwise change the vertical speed by lighting segments of these rows. The required vertical maneuver keeps the the pointer out of the red, and/or into the green areas.



**TCAS Flag**

**RA OFF (White)**

- TCAS is in STBY.
- TCAS in TA ONLY mode.
- Power loss in the RA/VSI.
- System operating in automatic TA ONLY mode.

**TCAS (Amber)**

- TCAS Failure

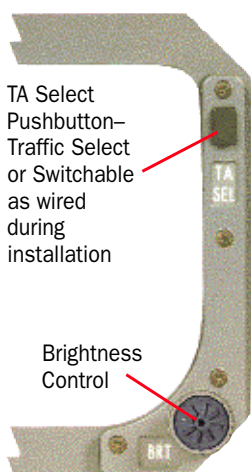
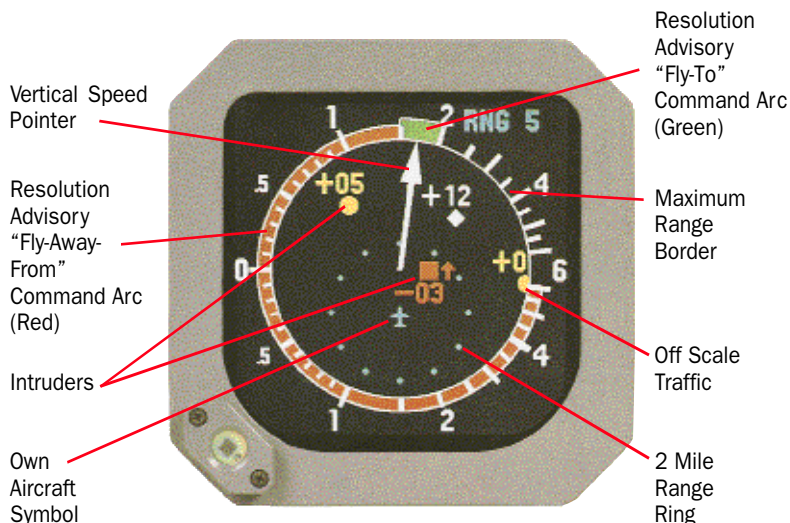
Both Flags disappear during normal operation.

The RA OFF/TCAS flag may appear independently of the VSI flag. Whenever the VSI flag appears the RA OFF flag will also appear.

# IVA-81A/VA-81D

## TA/VSI TRAFFIC ADVISORY/ VERTICAL SPEED INDICATOR

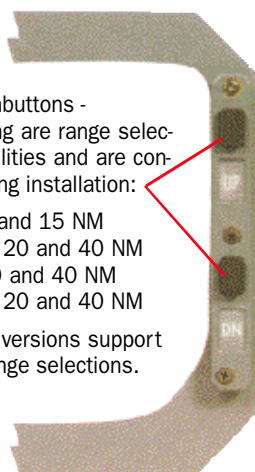
The TA/VSI combines the vertical speed instrument with the TA and RA display functions. Red and green bands around the circumference of the screen give RA information. Traffic location is presented on the face of the display inside of the vertical speed scale.



Range Pushbuttons - The following are range selection possibilities and are configured during installation:

- 3, 5, 10 and 15 NM
- 3, 5, 10, 20 and 40 NM
- 5, 10, 20 and 40 NM
- 3, 5, 10, 20 and 40 NM

Not all unit versions support all listed range selections.



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Versions of the IVA-81A/IVA-81D which have a TA Select pushbutton (TA SEL) on the bezel can be configured to operate in either the TRAFFIC SELECT mode or the SWITCHABLE mode. The following are descriptions of each mode of operation:

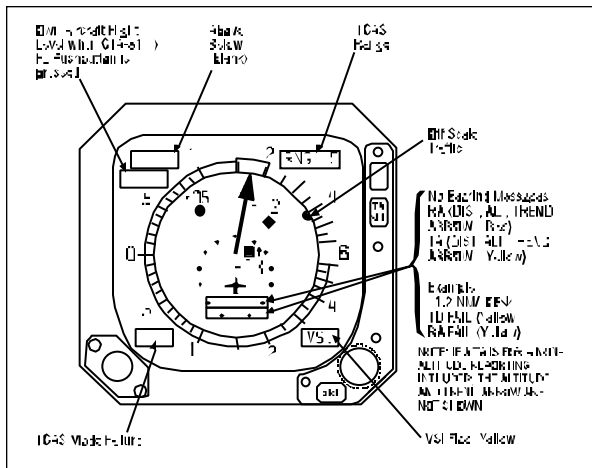
**CONFIGURED  
FOR TA  
SELECT**

When no TA or RA traffic is present, the IVA-81A/IVA-81D operates in the Vertical Speed Indicator mode only, with no TCAS Traffic Display overlay. Pressing TA Select will have no effect when no TA or RA traffic is in the area. When a TA or RA intruder is detected, the unit automatically changes to the Traffic Display mode with a Vertical Speed Indicator overlay. With an intruder present, pressing TA Select will revert the display back to VSI mode only. The unit automatically reverts back to the Vertical Speed Indicator mode when threat traffic is no longer present. The presence of a new TA or RA intruder will initiate a repeat of this cycle of operation.

**CONFIGURED  
FOR  
SWITCHABLE**

The IVA-81A/IVA-81D operates in either the Traffic Display mode or the Vertical Speed indicator mode, regardless of whether there is threat traffic present. The display formats are selected manually by pressing TA Select. When a TA or RA intruder is detected, and if the display format has not been previously manually selected, the unit automatically changes to the Traffic Display mode with a Vertical Speed Indicator overlay. Again, pressing TA Select will alternate between the two formats. The unit will not automatically revert back to the Vertical Speed only mode when threat traffic is no longer present. The presence of a new TA or RA intruder will initiate a repeat of this cycle of operation if the display format was Vertical Speed only format.

## DISPLAY MESSAGE LOCATIONS



### ***TCAS Mode/Failure***

### Standard

### Optional

TCAS STBY (Blue)	NO TCAS (Blue)	TCAS system in standby
TA/RA (Blank)	TA/RA (Blank)	
TEST (Yellow)	TEST (Yellow)	
TA ONLY (Blue)	TA ONLY (Blue/Yellow - when active TA)	
TCAS (Yellow)	NO TCAS (Yellow)	TCAS system failure

### Display Message Locations

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TYPICAL  
TA/VSI  
SCENARIOS









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## **SECTION 4**

### **System Considerations**

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Cautions . . . . .	67
Notes . . . . .	68

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**WARNINGS  
AND  
LIMITATIONS**

Warnings and Limitations specific to Change 7.0 or Change 6.04a are identified as such. The capability of TCAS II is dependent upon the type of transponder in the intruding aircraft:

- The intruding aircraft must be equipped with a properly operating transponder for normal TCAS operation. TCAS is unable to detect any aircraft without an operating transponder.
- If the intruder is Non-Altitude Reporting (NAR), TCAS will display only the range and bearing. It can issue a Traffic Advisory based on distance and direction of flight but will not generate a Resolution Advisory. TCAS assumes Non-Altitude Reporting (NAR) traffic is at the same altitude as your own aircraft.

TCAS does not display NAR traffic above 14,500 feet.

A TCAS II Resolution Advisory is based on the expectation that the crew will comply within 5 seconds. Any modification to the initial RA, including an increase or reversal to an RA, requires two and one half seconds reaction time.

The TCAS II processor is programmed with the specific aircraft operating limitations, i.e., maximum altitude at which the aircraft can climb at 1500 feet per minute. Climb or Increase Climb RAs are therefore inhibited when the RA maneuver cannot be completed safely due to lack of aircraft performance capability. These performance limits are included as part of the aircraft wiring. See the AFM (Airplane Flight Manual) for the specific performance limitations for your aircraft.

Wiring options for TCAS also include the following:

- TCAS II can be wired to display all traffic full time or all traffic only as a result of the presence of a TA or an RA.
- The TCAS display may have pilot selectable range or may be a fixed range controlled by

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the aircraft wiring.

- The TCAS II system can be automatically placed in standby when the aircraft is on the ground.
- The IVA-81A/IVA-81D can be wired to clear the display automatically after a TA or RA passes, or by pressing the TA SEL button, if applicable.
- The manually initiated TCAS test procedure can be inhibited in flight. However, this does not inhibit the transponder self test and TCAS will be placed in STBY during transponder Self-Test for approximately 5 sec.
- The aircraft Master Lamp Test Switch can be wired to control the TA/VSI and RA/VSI sequential lamp test.
- TCAS can be wired to inhibit display of Traffic on the ground when your own aircraft is below  $1700 \pm 50$  feet AGL. If configured this way, aircraft on the ground disappear as you descend through 1650 feet and reappear on the traffic display as you climb above 1750 feet. TCAS II designates "On-Ground" traffic by comparing own aircraft radio altitude and pressure altitude. Any intruder estimated by TCAS to be within 380 feet of the ground descending or 400 feet ascending will be categorized "On-Ground." If not configured this way, all "On-Ground" intruders are displayed as non-threat traffic (open white diamond). (Change 6.04a)

TCAS II does not display traffic on the ground.  
(Change 7.0)

In general, if the intruder is within  $380 \pm 20$  feet of the ground it will not be displayed. When another aircraft lands, it may take approximately 20 seconds for TCAS II to determine that it has done so. (Change 7.0)

When TCAS II is on the ground, it will display existing tracks down to 150 feet of the ground. Again, it may take 20 seconds for the system to determine that the aircraft has landed. (Change 7.0)

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Refer to the Airplane Flight Manual for the specific operational features of your particular TCAS installation.

Increase Descent Resolution Advisories are inhibited below 1450 feet AGL.(Change 6.04a)

Increase Descent Resolution Advisories are inhibited below 1450 feet AGL while descending and 1650 feet AGL while ascending.(Change 7.0)

All Resolution Advisories are inhibited below 900 feet descending or 1100 feet ascending.

All TCAS II audio warnings are inhibited below 900 feet Radio Altitude on approach and up to 1100 feet Radio Altitude on departure.(Change 6.04a)

All TCAS II audio warnings are inhibited below 400 feet Radio Altitude on approach and up to 600 feet Radio Altitude on departure.(Change 7.0)

Maneuvers based solely on the TCAS Traffic Display are prohibited by the AFM.

RAs should be followed without the autopilot or autothrottle system engaged.

TCAS II tracking range can be severely limited in high traffic areas. This is especially true of high traffic areas with a high density of TCAS equipped aircraft such as terminal areas and while on the ground. While on the ground, range may be reduced to below 5 miles. After takeoff range will increase, but may still be limited to under 10 miles.

This tracking range limiting is required in order to comply with FAA regulations, to ensure that TCAS II will not interfere with ATC ground station tracking. This should not be interpreted as a system malfunction.

The RDR-1E/ED and RDR-1F radar transmitters are controlled from a separate Radar Control Panel. When 5 or 10 mile NO WXR range is selected on the PPI-1U, the transmitter continues to radiate if an active mode (any mode except TEST) is selected on the Radar Control

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## CAUTIONS

Panel. Refer to the appropriate Weather Radar Operating Manual for Cautions and Limitations as prescribed by FAA Advisory Circular 20-68B.

Always attempt to visually clear the airspace before maneuvering your aircraft in response to a TCAS advisory. Do not over react to a Resolution Advisory. Fly only the vertical speed commanded. Using higher vertical speeds than that shown on the RA/VSI is NOT better. Be alert and comply with modified or weakening RAs (annunciated by “Adjust Vertical Speed, Adjust” for Change 7.0, or “Monitor Vertical Speed” for Change 6.04a) to minimize your displacement from your ATC clearance.

The TCAS installation is required to be wired to give GPWS and Wind Shear higher priority than TCAS. In case of simultaneous audio alarms, the TCAS II system is placed in TA ONLY mode (aural annunciations are inhibited) and the TA/VSI and RA/VSI flag will show RA OFF.

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## NOTES

When TCAS commands a corrective Resolution Advisory, sufficient time exists to perform a smooth vertical maneuver to avoid the conflict. TCAS II expects five second crew reaction time to initial RAs, requiring approximately .25 G. A change to the initial RA, including an increase or reversal, requires two and one-half seconds reaction time and up to .35 G.

It is possible to see an aircraft flying the same course and direction as your own aircraft and be in close proximity to your aircraft, yet TCAS II may not consider it a threat. TCAS II calculates the closure rate of the intruder, and derives the time to the closest point of approach (CPA). If there is no closure rate, no advisory will be issued, unless the intruder is very close (within approximately 1/4 mile).

Conversely, traffic at the same altitude very far ahead may be shown as an RA by TCAS because of a very rapid closure rate.

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## **SECTION 5**

### **Appendix**

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FUNCTIONAL  
AND  
AUTOMATIC  
SELF TEST

The Mode S transponder and TCAS Functional Test determines the operational status of the entire system. The test is initiated by rotating the function selector knob on the Transponder Control Panel to the counter-clockwise TEST position for one second. Thereafter, the test continues automatically for a period of approximately twelve seconds. During the test the TCAS II and transponder function is inhibited. When the knob is held for longer than twelve seconds the system remains in test until it is released.

If the weather radar indicator is OFF, warm up time for the weather radar indicators is about 5 seconds.

During the first few seconds of the test sequence, the control panel, the ITA-81A Dedicated Traffic Display, the radar indicators, the TA/VSI, and the RA/VSI execute a display test.

A test pattern appearing on the dedicated display, the radar PPI and the TA/VSI allow verification of each type of intruder symbol. The test generates the symbols arranged as shown. The Traffic Advisory Display annunciates the word TEST. If the weather radar is in the TEST function, this pattern appears over the PPI test pattern. If in a weather function, this test appears over weather.

Use of the self test function in flight will inhibit TCAS II and transponder operation for up to 12 seconds. For this reason, the pilot should use caution when initiating the test in flight.

**NOTE:**

Some installations may inhibit the activation of TCAS self-test in flight. However, TCAS will be placed in STBY while the Transponder is in self test for approximately 5 sec.

During the TCAS self test operation aircraft pressure altitude, aircraft Mode-S Address and aircraft maximum air-speed capability are not monitored. However, these transponder inputs are always monitored and faults reported while the TCAS is in one of its active modes – *TA Only* or *TA/RA*. Altitude Input to the selected transponder is monitored by the transponder but will **not** display a fault message when selecting transponder modes.



TCAS DISPLAY TEST PATTERN; TCAS FUNCTION,  
5 NM RANGE, DEDICATED DISPLAY AND PPI



TA/VS1 TEST PATTERN; 5 NM RANGE.

A Resolution Advisory (red square) will appear at 3 o'clock, range of 2 miles, 1000 feet below and flying level.

A Traffic Advisory (yellow circle) will appear at 9 o'clock, range of 2 miles 200 feet below and climbing.

Proximity traffic (solid white diamond) will appear at 1 o'clock, range of 3.6 miles, 200 feet above descending.

Non-Threat traffic (open white diamond) will appear at 11 o'clock, range of 3.6 miles, flying level 1000 feet above.

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**RA/VSI FLAGS  
AND TEST  
INDICATORS**

During the first few seconds of the TEST the RA/VSI red and green circumference lights (the climb/descend indicators) illuminate sequentially. The TCAS flag is in view throughout the test period.



SEQUENTIAL LAMP TEST

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After the sequential lamp test the red and green climb/descend lights display a fixed test command throughout the remainder of the system test.



FIXED TEST COMMAND

At the conclusion of a successful Self Test, a synthesized voice announces,

## **“TCAS System Test OK”**

### **RA/VS1 AND TA/VS1 LAMP TESTS**

#### **RA/VS1 LAMP TEST**

If the aircraft wiring includes a lamp test function, the RA/VS1 sequential lamp test can be observed by activating the Master Lamp Test switch. The test will continue as long as the switch is held in test position.

## TA/VSI LAMP TEST

The TA/VSI lamp test produces an array of traffic in the pattern shown. The climb/descend color bands alternate between green and red, lasting for two seconds each. The bands are blank for a one second interval in between.



**NOTE:** The VSI function of the TA/VSI will not be observed during the lamp test.

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**FAILURE  
CONDITIONS**

Should a VSI failure be detected at any time, the VSI flag will appear.

Should a failure be detected during Self Test, the audio message says,

**“TCAS System Test Fail”**

If the TA display is a PPI or dedicated display, the appropriate failure message will be displayed. (See Fault Message Format in Section 3: Controls and Displays.)

**TEST AUDIO  
INHIBIT**

TCAS test audio is inhibited during GPWS and windshear test or alert.

**CTA-81B  
CLOCKWISE  
TEST  
POSITION**

The CTA-81B function selector is moved to the right hand test position (switch fully clockwise) to test the ATCRBS transponder. During the test, segments of the Transponder Control Unit display window and the ATC Fail Lamp illuminate.

**POST FLIGHT  
REPORTS**

If a failure of the TCAS systems has occurred, give Maintenance as much specific information about the problem as possible. Avoid phrases such as “TCAS inop”.

Provide information in terms of fault lights lit, audio announcements, test patterns discrepancies and screen annunciations that indicate which unit was observed to have failed.

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## GLOSSARY OF TCAS TERMS

ABBREVIATIONS AND DEFINITIONS	AFM	Airplane Flight Manual.
	AGL	Above Ground Level.
	ATC	Air Traffic Control.A federally operated ground based system that manages aircraft traffic flow.
	ATCRBS	ATC Radar Beacon System.A ground based secondary radar and airborne transponder system used to monitor traffic.
	Absolute Altitude	Altitude above terrain.Also called Radio Altitude.Absolute altitude is received from a radio altimeter and used by the TCAS processor to determine distance to the surface.
	Altitude Tag	Data tag shown above or below threat symbol giving the relative altitude of the intruder.
	BITE	Built In Test Equipment.A feature of TCAS that continually monitors itself for operational errors.
	CPA	Closest Point of Approach.Refers to predicted point at which the intruder will be closest to your own aircraft.
	Crossover Climb, Crossover Descent	The maneuver that TCAS has determined to be appropriate is a climb or descent through the altitude of the threat aircraft.The crew is alerted to the crossover maneuver by an audio message.

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G-Force	The ratio between a given load and the pull of gravity. For TCAS purposes, G-forces of an RA could reach $\pm 3.5$ during an increase or reversal of the original command.
Increase Maneuver	An increase maneuver is a change of the original Resolution Advisory command, either climb or descent, requiring a greater rate. The increase maneuver could require G-forces to reach approximately $\pm 3.5$ .
Indicated Altitude	Altitude shown on the altimeter with barometric correction setting set to the local sea level pressure. Used by the crew below 18,000 feet but not used for TCAS processing.
Intruder	Any aircraft that is in the surveillance range of TCAS.
LRU	Line Replaceable Unit. A self-contained avionics component that can be replaced in the field.
Mode A Transponder	ATCRBS transponder that replies to ATC interrogations sending identification code but without giving altitude data.
Mode C Transponder	ATCRBS transponder that replies to ATC interrogations giving identification code or encoded altitude data.
Mode S Transponder	Transponder that replies to ATC interrogations giving an ATCRBS identification code, encoded altitude and other data fields including aircraft discrete address.



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MOPS	Minimum Operational Performance Standards per RTCA document DO-185. TCAS II Change 6.04a is specified by DO-185. TCAS II Change 7.0 is specified by DO-185A.
NAR	Non-Altitude Reporting traffic.
Non-Threat Intruder	An aircraft that has entered the TCAS surveillance volume at a greater distance than 6 miles or altitude greater than 1200 feet above or below your own.
Pressure Altitude	Indicated altitude when barometric pressure is set to 29.92" Hg (1013.15 mb). Pressure altitude is used by TCAS to determine the relative altitude of traffic.
Proximity Intruder	An aircraft that is within 6 miles range and with 1200 feet above or below our own aircraft but does not meet the TCAS definition of a threat.
Rad Alt	Radio Altitude. Altitude received from a radio altimeter and used by TCAS to determine distance to the surface. See Absolute Altitude.
RA	Resolution Advisory. An audio and visual indication recommending a vertical maneuver to achieve or maintain separation from an intruding aircraft.
RA/VSI	Resolution Advisory/Vertical Speed Indicator. A flight instrument that gives standard VSI indication plus RA climb and descend requirements.

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Relative Altitude	The difference in altitude between two aircraft.TCAS calculates relative altitude as the difference between your own aircraft's pressure altitude and the encoded pressure altitude of the intruder.
Reversal Maneuver	A reversal maneuver is a change of the original Resolution Advisory command from a climb to a descent or vice-versa. The reversal maneuver could require G-forces to reach approximately $\pm 3.5$ .
Self Test	A functional test that determines equipment status.Self test differs from BITE performance monitoring because it is initiated by the crew and is not performed continually or automatically.
Surveillance Volume	The volume of airspace surrounding your aircraft that TCAS scans for intruding traffic.The TCAS system scans approximately 40 NM in front of and 9,000 feet above and below the aircraft. The volume will automatically begin to decrease when flying into a high density area and may be reduced to approximately 15 NM in front of the aircraft.
TA	Traffic Advisory.An audio and visual indication that another aircraft is potential threat.A TA may become a Resolution Advisory within 15 seconds.
TA/VSI	Traffic Advisory/Vertical Speed Indicator.A flight instrument that gives standard VSI indication,plan position of local traffic,plus RA climb and descent requirements.

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Threat	An aircraft that has satisfied TCAS threat detection logic and thus requiring a Resolution Advisory.
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